

1. A free piston Stirling engine comprising:
 - a displacer;
 - a housing within which displacer reciprocates in both a first axial
 - 5 direction and a second axial direction; and
 - a machined spring attached at a first end to said displacer and
 - providing a constraining force upon said displacer when said displacer moves in
 - either said first axial direction or said second axial direction.
- 10 2. The free piston Stirling engine of claim 1 wherein said machined spring is
- attached at a second end of said machined spring to a displacer rod.
3. The free piston Stirling engine of claim 1 wherein said machined spring is
- attached to said displacer with at least one mounting screw.
- 15 4. The free piston Stirling engine of claim 2 wherein said machined spring is
- characterized such that the mass of said displacer and said displacer rod and the
- force constant of said machined spring results in mechanical resonance at the
- operating frequency of said free piston Stirling engine.
- 20 5. The free piston Stirling engine of claim 1 wherein said machined spring is
- formed as at least two intertwined coils of material.

6. The free piston Stirling engine of claim 5 wherein said material is steel.
7. The free piston Stirling engine of claim 1 wherein said machined spring comprises first and second end portions and a plurality of helical coils located
5 therebetween.
8. The free piston Stirling engine of claim 7 wherein said helical coils are intertwined.
- 10 9. The free piston Stirling engine of claim 1 wherein said machined spring is formed from a single piece of rod stock.
10. The free piston Stirling engine of claim 1 wherein said machined spring is contained within said displacer.
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11. A displacer in a free piston Stirling engine comprising:
a displacer rod;
a displacer housing within which said displacer rod reciprocates;
a machined spring attached at a first end to at least a portion of said
20 displacer rod and providing a constraining force upon said displacer rod when said displacer rod moves in either a first axial direction or a second axial direction within said displacer housing.

12. The displacer of claim 11 wherein said machined spring is attached at a second end of said machined spring to said displacer housing.

13. The displacer of claim 11 wherein said machined spring is characterized
5 such that the mass of said displacer and said displacer rod and the force constant of said machined spring results in mechanical resonance at the operating frequency of a free piston Stirling engine containing said displacer.

14. The displacer of claim 11 wherein said machined spring is formed as at
10 least two intertwined coils of material.

15. The displacer of claim 14 wherein said material is steel.

16. The displacer of claim 11 wherein said machined spring comprises first and
15 second end portions and a plurality of helical coils located therebetween.

17. The displacer of claim 16 wherein said plurality of helical coils are intertwined.

20 18. The displacer of claim 11 wherein said machined spring is contained within said displacer.

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